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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/816,089 | 03/31/2004 | Chien-Chao Huang | 67,200-1223 | 9487 |

7590 04/06/2006

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EXAMINER

PIZARRO CRESPO, MARCOS D

| | |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

2814

DATE MAILED: 04/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/816,089

Applicant(s)

HUANG ET AL.

Examiner

Marcos D. Pizarro-Crespo

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 21-30 and 40-53 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 21-30 and 44-46 is/are allowed.
- 6) ☒ Claim(s) 1-4, 40-43, 47-50, 52 and 53 is/are rejected.
- 7) ☒ Claim(s) 5 and 51 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Application/Control Number: 10/816,089 (Final Rejection)
Art Unit: 2814

Page 2

Attorney's Docket Number: 67,200-1223

Filing Date: 3/31/2004

Claimed Foreign Priority Date: none

Applicant(s): Huang et al.

Examiner: Marcos D. Pizarro-Crespo

DETAILED ACTION

This Office action responds to the amendment filed on 2/13/2006.

Acknowledgment

1. The amendment filed on 2/13/2006 responding to the Office action mailed on 9/30/2005, has been entered. The present Office action is made with all the suggested amendments being fully considered. Accordingly, pending in this Office action are claims 1-5, 21-30, 40-53.

Duplicate Claims

2. Applicant is advised that should claim 52 be found allowable, claim 53 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 2, 40-42, 47, 48, 52, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mikagi (US 6566254) in view of Miyanaga (US 6897526).

6. Regarding claim 1, Mikagi shows (see, e.g., figs. 3A-4) most aspects of the instant invention including a semiconductor device comprising:

- A substrate **101** having a surface orientation
- A gate electrode **104** formed on the substrate **101**
- Slim spacers **105** formed on top of the substrate **101** adjacent the gate electrode **104**
- Source/drain extension regions (SDE)

wherein the spacers are thinned to expose underlying portions of the SDE regions (see, *e.g.*, fig. 3D).

Mikagi, however, fails to specify that the surface orientation of the substrate is (100) and that the source/drain regions are oriented having a source-to-drain axis along the <100> direction. Miyanaga (see, *e.g.*, col.5/ll.59-col.6/ll.2), on the other hand, teaches that having a substrate with a (100) surface orientation and source/drain regions oriented along the <100> would allow to uniformly add an impurity under Mikagi's gate that will suppress the short channel effect while at the same time minimizing any damage to the substrate.

It would have been obvious at the time of the invention to one of ordinary skill in the art to have a (100) surface orientation for Mikagi's substrate and to have the axis of the source/drain regions oriented along the <100> direction, as suggested by Miyanaga, so that the short channel effect in the device can be suppressed.

7. Regarding claim 2, Mikagi shows the width of the spacers is less than about 500 angstroms (see, *e.g.*, col.4/ll.13).

8. Regarding claim 40, Miyanaga shows a PMOS device comprising the gate electrode (see, *e.g.*, fig. 3).

9. Regarding claim 41, Mikagi shows (see, *e.g.*, fig. 4) the spacers having a width that is less than the width of the SDE region by greater than about 20%.

10. Regarding claim 42, Mikagi shows silicide portions **107** on the SDE regions (see, *e.g.*, fig. 4).

11. Regarding claim 47, Mikagi shows (see, e.g., figs. 3A-4) most aspects of the instant invention including a semiconductor device comprising:

- A substrate **101** having a surface orientation
- A gate electrode **104** formed on the substrate **101**
- Slim spacers **105** formed on top of the substrate **101** adjacent either side of the gate electrode **104** thinned to control a channel stress (see, e.g., col.4/ll.47-50)

Mikagi, however, fails to specify that the surface orientation of the substrate is (100) and that the source/drain regions are oriented having a source-to-drain axis along the <100> direction. Miyanaga (see, e.g., col.5/ll.59-col.6/ll.2), on the other hand, teaches that having a substrate with a (100) surface orientation and the source/drain regions oriented along the <100> would allow to uniformly add an impurity under Mikagi's gate that will suppress the short channel effect while at the same time minimizing any damage to the substrate.

It would have been obvious at the time of the invention to one of ordinary skill in the art to have a (100) surface orientation for Mikagi's substrate and to have the axis of the source/drain regions oriented along the <100> direction, as suggested by Miyanaga, so that the short channel effect in the device can be suppressed.

12. Regarding claim 48, Mikagi shows the width of the spacers is less than about 500 angstroms (see, e.g., col.4/ll.13).

13. Regarding claims 52 and 53, Mikagi shows the spacers having a top portion at about the same level as the top portion of the gate electrode (see, e.g., fig. 3A).

14. Claims 3 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mikagi/Miyanaga in view of Ito (US 6656853).

15. Regarding claims 3 and 49, Miyanaga teaches using a 0.18 μ m wiring design rule (see, e.g., col.1/ll.63); thereby the length of the gate electrode is 180 nm (see, e.g., col.8/ll.11). Mikagi, on the other hand, talks about the tendency in the semiconductor industry of increasing fineness in semiconductor devices that become finer in dimension (see, e.g., col.1/ll.22-25). More specifically, the dimensions of gate electrodes become finer and finer (see, e.g., col.1/ll.26-27). As an example, Mikagi shows a gate electrode of about 100 nm wide (see, e.g., col.4/ll.11).

In spite of the above, Miyanaga and Mikagi both fail to show the claimed gate length of less than about 80 nm. The specification, on the other hand, fails to provide teachings about the criticality of having a gate length of less than about 80 nm. However, differences in thicknesses will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such thicknesses are critical. "Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the workable ranges by routine experimentation". *In re Aller*, 220 F.2d 454,456,105 USPQ 233, 235 (CCPA 1955).

Since the applicants have not established the criticality (see next paragraph) of the claimed gate length and since similar gate lengths are in common use in similar devices in the art (see, e.g., Ito/col.6/ll.30), it would have been obvious to one of ordinary skill in the art to use these values in the device of Miyanaga.

CRITICALITY

16. The specification contains no disclosure of either the critical nature of the claimed gate length or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

17. Claims 4, 43, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mikagi/Miyanaga in view of Brigham (US 6046494).

18. Regarding claims 4 and 50, Mikagi/Miyanaga shows most aspects of the instant invention (see, e.g., paragraphs 6 and 11 above). Miyanaaga also shows a dielectric layer **427** over the gate electrode and spacer (see, e.g., fig. 6C) but fails to show that the layer is in on tensile stress. Brigham (see, e.g., fig. 2 and col.1/ll.25-30), on the other hand, teaches that using a tensile-stress dielectric layer over Mikagi/Miyanaga's gate and spacers would reduce saturation current degradation and shifting of the threshold voltage.

It would have been obvious at the time of the invention to one of ordinary skill in the art to use Ito's tensile-stress dielectric layer over Mikagi/Miyanaga's gate and spacers to reduce shifting of the threshold voltage.

19. Regarding claim 43, Brigham shows the dielectric layer is a silicon nitride layer (see, e.g., col.5/ll.27).

Allowable Subject Matter

20. Claims 5 and 51 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

21. Claims 21-30 and 44-46 are allowed.

Response to Arguments

22. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

23. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

24. A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

25. Papers related to this application may be submitted directly to Art Unit 2814 by facsimile transmission. Papers should be faxed to Art Unit 2814 via the Art Unit 2814 Fax Center. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2814 Fax Center

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number is **(571) 273-8300**. The Art Unit 2814 Fax Center is to be used only for papers related to Art Unit 2814 applications.

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Marcos D. Pizarro-Crespo** at **(571) 272-1716** and between the hours of 10:00 AM to 8:30 PM (Eastern Standard Time) Monday through Thursday or by e-mail via Marcos.Pizarro@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy, can be reached on (571) 272-1705.

27. Any inquiry of a general nature or relating to the status of this application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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28. The following list is the Examiner's field of search for the present Office Action:

| Field of Search | Date |
|------------------------------------------------------------------------------------------|-----------|
| U.S. Class / Subclass(es): 257/288, 344, 382-384, 408 257/412, 413, 638-640, 649, 900 | 3/23/2006 |
| Other Documentation: | |
| Electronic Database(s): EAST (USPAT, EPO, JPO) | 3/23/2006 |


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MDP/mdp
March 23, 2006